A 48-year-old woman with a severely atrophied maxilla was treated with open sinus augmentation surgery along with Le Fort I osteotomy with a pedicled buccal fat pad graft to position the maxilla in a right occlusal plane with respect to the mandible and to construct adequate bone volume allowing proper implant placement. Six dental implants were inserted in the maxilla, and a fixed metal-resin screw-retained prosthesis was fabricated for the maxilla and mandible.

Key Words: implant, sinus augmentation, osteotomy, buccal fat pad

INTRODUCTION

In posterior maxilla, tooth extraction induces atrophic bone situation and sinus pneumatization and restricts the application of implant therapy. Of the various augmentation procedures currently in use, definitely the most volumetrically stable bone graft in the jaws is the sinus bone graft. In severely atrophied maxilla in which there is increased interarch space, LeFort I osteotomy surgery with autogenous interpositional bone grafts allows forward and/or downward repositioning of the maxilla and bone construction for insertion of appropriately sized implants. Moreover, vertical augmentation by a Le Fort I down graft has been reported to be stable enough for implant placement in a high percentage of cases. The chief concern with this type of therapy is the potential ischemia of extruded segment of bone, which lacks blood supply. It has been shown that by using the buccal fat pad (BFP) for additional and immediate blood and nutritional supply, the quality of bone could be improved.

The present report addresses the treatment of a patient who presented with severe maxillary bone resorption, extreme maxillary retrusion, and an increased interarch distance with pseudo Class III occlusion treated with sinus augmentation with a mixture of iliac bone block and biphasic bone substitute (hydroxyapatite/tricalciumphosphate).
sandwich bone grafting followed by Le Fort I osteotomy using a pedicled BFP graft.

**Clinical Report**

A 48-year-old healthy Caucasian woman presented to the Department of Oral and Maxillofacial Surgery, Shahid Beheshti University of Medical Sciences, for rehabilitation of her edentulous maxilla and mandible. Her general health was good without a contributive medical history. The patient's chief complaints were that she had a loose-fitting denture and an unesthetic smile. Because of early loss of maxillary teeth and protracted use of complete denture, bone resorption had led to a lack of vertical and horizontal bone dimensions in the upper jaw, extreme maxillary retrusion, and an increased interarch distance with pseudo Class III occlusion. The initial radiographs (panoramic and computerized tomograms) and patient profile revealed excessive bone resorption of maxilla, marked retrodisplacement of the maxilla, minimal vertical projection, and bilateral large sinus cavities (Figure 1). The residual bone height (RBH) was 1 mm at the former position of the maxillary centrals, 0.5 mm of the second premolar, and 2–3 mm of the first molar. The patient was advised to undergo open sinus augmentation surgery along with Le Fort I osteotomy with a pedicled BFP graft to position the maxilla in a right occlusal plane with respect to the mandible and to construct adequate bone volume allowing for proper implant placement. The patient signed a written informed consent form. After mounting the diagnostic casts, anterior and downward movements of the maxilla were evaluated in accordance with the estimated intermaxillary relation, desired occlusal plane, estimated position of the implants, and facial esthetic improvement. A 12-mm advancement and a 14-mm lowering of the maxilla were indicated.

**Surgical Procedure**

The patient was treated in the oral and maxillofacial center of Taleghani Hospital under general anesthesia with nasotracheal intubation. A vestibular incision was made from molar to molar, 10 mm away from the maxillary crest area without any releasing incision. The lateral and anterior wall of the maxilla was exposed by reflecting the nasal mucosa from the inferior and lateral walls of the piriform aperture, a bony window was outlined with a round bur. When the outline was completed, the sinus floor was then elevated by delicate push of a thin lateral wall. The Schneiderian membrane was anatomized from the sinus floor by using elevators so that it was completely free inferiorly and medially. An osteotomy line was made with the reciprocating saw from the posterior mandible to the anterior maxilla, which passes from the skeletonized sinus floor without jeopardizing sinus membrane integrity. The pterygomaxillary junction, lateral nasal wall, and anterior nasal spine were osteotomized respectively with thin osteotome, and the Lefort I procedure was performed in a classic manner. A thin wire was passed from the anterior maxilla and helped the maxilla to be mobilized. The down-fractured maxilla was pulled forward and downward to the predetermined model study position and fixed with a mini L-plate.
in the anterior part and two 4-hole mini plates in the posterior part just over the zygomatic buttress (Figure 2). The length of the plates was 14 mm, which was equal to the desired amount of the down-fractured maxilla. At the same time, a monocortical bone block of autogenous bone graft was harvested from the medial surface of the anterior iliac crest, and 10 cm³ of corticocancellous bone was obtained from curetage of the raw osteotomized iliac bone surface. Ilium surgical access was closed in layers after adequate homeostasis. The iliac bone block was reduced to 2 pieces with the dimensions of 12 mm × 20 mm × 5 mm (height × length × width), and each piece was placed between the stabilizing plate on each side of the posterior maxilla. The harvested corticocancellous bone was expanded to 20 cm³ by adding 10 cm³ of HA/TCP biphasic bone substitute (Osteon, Dentium, Seoul, South Korea). The mixture was added in the anterior remaining space and over the posterior bone block. To stabilize the corticocancellous mixture in the anterior area, a 0.2-mm titanium mesh (Dentium, Seoul, South Korea) was molded over the mixture and fixed with a 1-mm microscrew (Dentium) to the remaining bone of the anterior nasal spine (Figure 3). The BFP was uncovered by a 2-cm horizontal periosteal incision lateral to the maxillary buttress extending backward above the maxillary second molar tooth. Blunt dissection through the buccinator and loose surrounding fascia allowed the BFP to be herniated into the mouth. The body of the BFP and the buccal extension were gently mobilized by blunt dissection, taking care not to disrupt the delicate capsule and vascular plexus and to preserve as wide a base as possible. Pressure on the cheek helped to express the fat into the mouth (Figure 4). After the pad had been dissected free from the surrounding tissues, it was grasped with vascular forceps, advanced, and expanded over the new reconstructed maxilla and sutured to L mini plates in each side. The buccal mucoperiosteal flap was released with 2 vertical-releasing incisions in the tuberosity area, and continuous vertical mattress tension-free sutures were used to close the flap gently.

Antibiotic therapy was administered at 2 g/d, beginning the day after surgery for 7 days. The patient was advised to eat soft foods for 2 weeks and to perform appropriate oral hygiene with twice-daily rinsing with 0.2% chlorhexidine mouthwash. Sutures were removed 14 days postoperatively intraorally and at the donor site. The patient was not allowed to wear removable dentures before implant placement; the healing process was monitored accurately. Five implants (Dentium, Implantium) were inserted in the mandible using a surgical template to assist appropriate implant placement.

Four months after surgery, radiographic evaluation showed an appropriate healing with the stable bone height around 20 mm in both the posterior and anterior maxillary area (Figure 5). A molar-to-molar crestal incision was performed, and the mucoperiosteal flap was elevated to expose all of the fixation devices. The new reconstructed maxilla beneath the osseosynthesis material looked well vascularized, and D3 bone density was felt under the experienced surgical hand (Figure 6). Osteosynthesis plate and screw removal and dental implant insertion were performed under local anesthesia. Six implants (Dentium, Implantium) with dimensions of 4.3 mm × 10 mm were placed in the maxilla. The implant insertion torque value was no greater than 20 N/cm for all implants (Figure 7).

**Prosthetic rehabilitation**

After 4 months, a definitive impression of the implants was made with a regular-viscosity polyether (Impregum F, Espe Dental, Seefeld, Germany) in a custom impression tray. The
right-side posterior implant failed during removal of the impression. Screw-retained metal-resin–fixed complete dentures were fabricated with an occlusal scheme that provided simultaneous contact in maximal intercuspsation and group function articulation.

**Follow-up**

After an ordinary healing period of 24 months, the implants were clinically stable. The final prosthesis was functioning at the follow-up visit. The RBH was 10 mm at the former position of the maxillary first premolar, 12 mm of the second premolar, and 11 mm of the first molar. No additional implant was lost during the observation period. During the clinical and radiographic examinations at the 24-month follow-up, no clinical or radiographic signs of inflammation (pain, infection with supputation, mobility, and radiographic continuous peri-implant radiolucency) were seen. Periodontal and peri-implant soft tissues showed no variations and were healthy, presenting normal probing-depth values.
The main basic prerequisites for reconstruction of the edentulous maxilla and mandible are sufficient bone mass and ortholalveolar form. These can be obtained by augmentation of the available substrate using accepted techniques such as vertical and lateral augmentation of the alveolar ridge, sinus floor augmentation, and orthognathic surgery. According to the initial condition, one or more of these options can be used to improve supporting capacity for implants. The resorption of the edentulous maxilla and mandible often leads to a discrepancy between the jaws such that a significant Class III malocclusion occurs. Edentulous patients with a skeletal Class III jaw relationship have a poor chance of successful oral rehabilitation if they are provided solely with implant-supported prostheses, except when supplementary surgery is also provided.

Sailer reported a method of Le Fort I osteotomy in combination with concurrent bone grafting in the anterior and posterior maxilla and placement of osseointegrated implants for treatment of patients with atrophied maxillary alveolar bone and Class III jaw relationship. This sandwich technique enables simultaneous correction of the sagittal intermaxillary relationship and the vertical dimension. Some reports highlighted advantages such as low morbidity and satisfactory long-term results of the 1-stage procedure, but others choose the 2-stage method because the long-term results seem slightly superior to the 1-step procedure and concurrent placement of osseointegrated implants leads to an increase in the risk of bone necrosis and makes it difficult to obtain the desired position and angulations of the inserted implants. In a case reported by Depprich et al., sinus lifting was performed 3 months before Le Fort I maxillary osteotomy in a patient with severe mandibular and posterior maxillary alveolar atrophy and skeletal Class III condition. Furthermore, several studies have achieved good results with Le Fort I osteotomy in relation to interpositional iliac grafts. The chief concern with this type of therapy is the potential ischemia of the extruded segment of bone, which lacks blood supply. The BFP has gained extensive acceptance and popularity in recent years. The advantages of the BFP flap include the simplicity of harvesting, ease of the technique, and high success rate. The authors have presented a case with a bilateral sinus-lifting procedure and a simultaneous BFP graft for Lefort I osteotomy. To the best of our knowledge, the adoption of the maxillary Le Fort I approach using a pedicled BFP graft has not been previously described. The technique described here differs from the classic Le Fort I osteotomy, and this avoids the presence of morbidity and other complications associated with iliac and other common grafts. To sum up, Le Fort I osteotomy in association with BFP graft and sinus augmentation led to high alveolar bone gain. One of the great advantages of using BFP is the avoidance of invade surgery. Before bringing this treatment protocol as a standard repertoire graft for Le Fort I osteotomy, more cases and longer follow-up are warranted.
ABBREVIATIONS

BFP: buccal fat pad
HA/TCP: hydroxyapatite/tricalciumphosphate
RBH: residual bone height

REFERENCES